GUIDE

TO THE

English Landmarks

OF THE

SOIL AND CROPS.

LANCASTER, PA.
INQUIRER P. & P. COMPANY.
1879.

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TO THE

ENGLISH LANDMARKS

OF THE

SOIL AND CROPS.

BY

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Economy in the government of the Soil, is more important than the economy of State.

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INTRODUCTION.

An accurate, yet simple Map and Guide, to assist the Farmer in learning the chemical nature of his soil and crops, has been a necessity long felt and earnestly sought after; but the subject has been so difficult to simplify, that it has proven a failure until the present time. The Author does not lay any special claim to originality. He has only simplified a difficult and complex subject by years of hard study, and by engaging the opinions of the best chemists of Europe and America in this compilation. The virgin soil of the United States has been exhausted; from this the Farmer in days past made his living without the necessity of an education. To succeed now, the Farmer must study the chemistry of his soil; its nature and diseases. He must be a physician to his land, and learn how to treat the diseases of his soil. Most Farmers imagine that clover will meet all ends. Let me tell him, he may turn crop after crop of clover under, and he will never get a wheat or corn crop upon it, until he puts in the soil the standard ingredients of these crops. Let him refer to the map, and he will see at once the great difference between hay, corn and wheat.

The Author modestly offers his Map and Guide to the Farmers of the United States, trusting they will find it a ready assistant in promoting their welfare.

ANALYSIS OF SOILS AND PLANTS.

Two kinds of analysis become necessary in cultivating land to advantage; 1st. Physical Analysis; 2d. Chemical Analysis.

1st, Physical Analysis.

By this we mean the physical appearance or surface indications of the soil, such as the natural growth upon the land, and the color of the soil.

We can very frequently determine the quality of the soil by the character or kind of weeds found upon it. If the weeds are full and rank, and growing tall, we know it is an indication of rich land, with a good supply of organic matter already in the soil, probably deficient only in mineral matter. If the weeds are feeble and thinly scattered over the land, we know the land is poor, and requires organic or vegetable matter as a manure, as well as mineral. If the weeds are small, and of the creeping, thorny, prickly, sour kind, we may rest assured we have land that will be unfit for a long time for cultivation, and only overcome by sheep grazing and mattock grubbing.

The natural growth upon land can only be nourished through the food that is in the soil and atmosphere. It would be a matter of impossibility for us to analyze every weed growing upon land, but by grouping and classifying them, and applying the test of experience and reason, we will be surprised to know how much information we can gain in a few years.

Suppose we reason and reflect in this manner: What kind of plant or weed grows upon a rich soil? What kind upon a fair soil? What kind upon a poor soil? This seems a practical way to analyze a soil. "The weeds growing upon land, according to their size and vigor, give us some insight into the character and quality of the soil; for it is well known that the ashes of plants contain almost invariably the same constituents, and the differences between them are caused principally by differences in the relative proportions in which the several constituents are present."

Study closely the natural growth upon your land, and the color of the soil; whether it is of a light or dark, clay or sandy appearance, or whether colored from iron or vegetable decay, and analysis will soon become a pleasure.

2d, Chemical Analysis of Plants.

Plants or weeds are composed of organic and inorganic parts. The organic part of the plant is the part that is driven off or destroyed in burning. It constitutes much the largest part of the plant—90 to 95 per cent., and is derived principally from the air—God's laboratory. The organic constituents then of plants are Carbon, Oxygen, Nitrogen and Hydrogen, which come from the gum, starch, sugar, oil, woody fibre, water, and the air of the plants.

"The whole of the organic part of vegetables and plants, the whole of the atmosphere, all water, and a very large part of the solid rocks which make up this globe, consist of one, two, three, or all of these four substances united in different proportions."

These names appear difficult to understand to the practical farmer, but when he is told they are only gases pervading all nature, he becomes reconciled to the laws of nature.

The Inorganic Part of Plants.

The inorganic part or ashes of the plant is the part for the practical farmer to consider. It constitutes but a

small part of the plant, and was, for a long time, considered in the light of an impurity. The analysis of plants shows certain substances in varying proportions, and however small or insignificant the quantity, they play an important part.

"The ash of the same plant, grown upon different soils, was found to have a composition of nearly the same nature; thus showing that it did not feed or grow npon everything that might come in contact with its roots, but selected only the material or food it required and found necessary for its growth."

The ash of plants is composed of generally ten substances in varying proportions, namely:

1st. Potash; similar to common Lye; Ashes.

2d. Soda; similar to common Salt, and found in native state.

3d. Lime; similar to Quicklime; plaster, marls, etc.

4th. Magnesia; similar to Chalk; gotten from magnesian limestone.

5th. Iron; appearance of common Iron rust.

6th. Manganese; is a metal something like iron; little value.

7th. Silica; similar to common quartz, flint, agate, sand, etc.

8th. Chlorine; a gas of green color; of but little value.

9th. Sulphuric Acid; same as common Oil of Vitriol.

10th. Phosphates; gotten from bones by applying Oil Vitriol.

These ten substances, found in the ashes of plants, are found in different proportions in all the weeds growing upon your place. If the soil is rich, you will find the weeds large and well developed. If the soil is poor, you will find them feeble and small.

The Organic and Inorganic parts of crops have the same substances as plants. By knowing what crops are upon the land, you can test for yourselves what is needed in the soil, (provided you have faithfully worked it, and put it in, in the proper season,) and whether a change of crops should be made.

You will know what the crops take from the soil, and, of course, will reason that a proper return should be made.

Analysis of Soils.

Here, as in plants and crops, we have an organic and inorganic part. In the soil the inorganic part is the largest, whilst in plants it is very small.

"The organic part is derived from the decay of animal and vegetable matter. The inorganic is derived from the decomposition of rocks. The inorganic part of the soil consists of the same substances as the inorganic part of plants and crops, with the addition of alumina.

"Alumina is a white substance, which gives stiffness to clays. A very fertile soil contains all of these substances in considerable quantities."

"The three principal varieties of rocks, are limestone, sandstone, and clay. Soils take their names from one of these rocks. We have only to apply our test for each substance, if we desire a thorough chemical analysis. This we recognize at once as very difficult, and indeed, I may say, totally unnecessary; we must therefore reduce it to a practical analysis which every man capable of reading and writing can appreciate.

Some of the substances we can understand by a mere surface examination. For instance, every farmer can judge when he has too much or too little Silica (sand) or Alumina (clay) in his land. Where the soil is too stiff, he recognizes the importance of adding Silica (sand); or Alumina (clay), where the soil is too light or sandy.

To find out the organic substances in the soil, we determine the quantity and quality, by the amount of decaying matter found in turning up the land. By burning a certain quantity of the soil, the organic matter, which is very small, is driven off in the form of smoke into the atmosphere, leaving the ashes, which is the inorganic part.

Inorganic Part of Soil.

We have already determined upon the Silica and

Alumina; the other substances will be more difficult of recognition. We will now determine their solubility in watcr and acid.

Substances Soluble in Water.

Weigh a pound of air dry soil or earth, and boil it in water for several hours—rain water is the best; then filter it through coarse porous paper, such as the druggists use. Continue to filter until the liquid comes through clear. Take the solution thus filtered, and evaporate until you drive off the water, which will leave a solid residue or extract behind. Burn this extract to drive off the organic matter, which is the decaying vegetable and animal matter in the soil. Weigh the residue or ashes left after burning, on a small pair of well-balanced scales, and the weight will give you the inorganic matter, soluble in water, found in the soil. You will find this inorganic part composed mostly of potash, soda, and some common salt. The amount thus found soluble in water is not large, yet adds greatly to the soil.

Substances Soluble in Acid.

Weigh another pound of air dry soil or earth, and add a small quantity of Muriatic Acid, diluted with two or or three times its bulk of water. If the soil contains much lime in the form of carbonate, it will effervesce or bubble up rapidly. If the bubbling is active, you can pretty well determine you have a good quantity of lime in the soil; if very violent, it is in excess. If the bubbling is very feeble, the lime is deficient. Very strong vinegar will sometimes answer in this experiment instead of Muriatic Acid.

Filter this acid mixture (or portion of soil already weighed, with acid added,) until it no longer tastes acid. Burn the residue to drive off, or set free, the organic matter. After burning, weigh the ashes, and the weight will determine the amount of insoluble silicious matter in the soil. Add now common water of ammonia, until it

shows an alkaline reaction with litmus paper. If a flocculent precipitate falls by the addition of the ammonia, you have Iron and Alumina in the soil. If the precipitate is of a deep red color, the Iron is in excess, and the contrary if but feebly red. If the precipitate has a whitish green color, and reddens when exposed to the air, the soil contains the protoxide of Iron, in place of the peroxide of Iron.

The protoxide of Iron is very injurious to plants. It is for this reason important to know which form of Iron is present. Nitrate of Baryta, added to another portion of this acid mixture of earth, gives a white powdery precipitate, if the solution contains Sulphuric Acid.

Molybdate of Ammonia, added to another acid portion of soil, gives a yellow precipitate, if Phosphoric Acid is present. Bichloride of Platinum, added to another acid portion, gives a yellow powdery precipitate, if Potash is present. The principal substances composing the soil have been subjected to analysis, and yet, as simple as it may appear, it will be found difficult of execution. Would advise the active laboring farmer (if not educated) to use only the test for lime, which is very simple as well as important, and use a different system for the remainder; watching closely the effect of cropping upon the land.

Different crops take away the inorganic substances of the soil in different proportions.

1st The grains contain chiefly the Phosphates.

2d. Potatoes and Turnips, mostly Potash and Soda.

3d. Grasses, for the most part, Lime and Silica.

4th. Straw, composed mostly of Silica.

This explains the principle of rotation of crops—one crop may find food, when the land has been exhausted for another. The value of land is kept up by a judicious rotation of crops for a long time, but you must always return to the soil what you have taken away.

When the farmer wishes to put in a crop, let him refer to his map to find out the principal substances of that crop, and what was taken from the soil by the previous crops. If it was corn or wheat, for instance, he will find,

by reference to the map, he has taken Potash and Phosphoric Acid in large quantities from the soil. If he wishes to put in the same crop or like crops, he must return these substances to the soil in the form of fertilizers or manures containing them.

We find wheat straw composed of 80 per cent. of Silica. "This Silica (sand) is intended to give straw its stiffness, strength and elasticity. When there is not sufficient supply of it in the soil, the straw falls down or lodges, as the farmers say." The same may be said of the straw of all grains, and the stalk of all grasses. Straw as a manure is of but little value.

Phosphoric Acid is the principal substance found in the grain or head of wheat, corn, oats, rye, barley, buckwheat, etc. In root crops, as a general thing, potash and soda are most abundant.

By this system of analysis and reasoning, the farmer will not find much trouble in thoroughly understanding the diseases of his soil. Administer the remedies in the form of vegetable, animal, and mineral manures, and you will have but little trouble in checking the disease.

Fertilizers or Manures.

Anything that will nourish and feed your land may be looked upon as a manure. This manure must be either bought or made upon your farm. Manure requires but little outlay of money, but plenty of your strongest elbow-grease. Give plenty of this kind of grease, and you can fertilize your land at but little cost. Every thing you can think of in the way of green weeds, straw, muck, cornstalks, rubbish, chips, rags, leaves, decaying wood, bones, earth, rocks, stable manure, the droppings from cows, sheep, human excrement, urine, the refuse from the kitchen, etc—these things, and many more, will go to form your compost heap.

Compost Manure.

This is a kind of manure made entirely on the farm; with it, you can safely pass by all the fertilizers—with it,

judiciously and properly made and applied, your land will be enriched, and your crops increased many fold—with it, you will gradually destroy all noxious weeds, and convert them into friends—with it, you will gradually become independent in life, and cash your own checks. With *it*, twenty-five acres of land, properly managed and brought to a high state of cultivation, will comfortably support a large family, and fifty acres will enrich you in due season. If you would succeed in farming, never own beyond one hundred acres of land; more than this will bankrupt you.

This kind of manure can be made all the year round, and need not interfere with the regular farm work. In the first place the farmer should dig a cistern or tank, water tight, in a convenient place under cover, of the capacity of a hundred gallons or more, and throw some rails over it. Upon these rails he should place every day or so the litter of the stable, the droppings of cows, horses, etc., and all rubbish about the yard or garden, together with contents of chambers. After he has made a layer of several inches in thickness, he should place a similar layer of muck, earth, etc., and thus continue layer upon layer, first of manure and then of earth, throwing in straw, corn and tobacco stalks, green weeds, rotting wood, leaves, bones, and flesh of any kind, ashes, etc. Take the mowing blade, and wherever weeds are growing, whether in yard or garden, corners of fences or field, cut them for your compost heap. The fermentation the weeds are carried through entirely destroys the seed. If you can get a drain from the stable and privy to your compost heap, so much the better, as you will be saving something very valuable. You must keep the heap sufficiently wet by pouring water upon it. In Flanders, the liquid manure of a single cow, for a year, is valued at $10. You must add to the compost heap occasionally a small quantity of plaster, lime unslacked, salt, etc., and carry it through a gradual fermentation, by pouring upon it the drain from the heap, until you are satisfied the pile has pretty well rotted; then haul it out, and spread upon

the land to make room for another compost heap. This can be done at odd times during the year.

Having made your manure, with hardly any cost, one thing more is needed to complete the work, namely, the addition of Phosphoric Acid. From bones we get Phosphoric Acid. It will be remembered that the ashes of grain is particularly rich in phosphates; consequently as gran is generally sold off, the phosphates are most readily exhausted; in bones, therefore, we find just the manure for restoring them, and with little expense. There are few farms on which bones enough might not be collected in the course of a year, to help out in this way the manuring of several acres. These bones can be gradually dissolved by pouring common commercial Sulphuric Acid (Oil of Vitriol), mixed with two or three times its bulk of water (as the acid is too strong by itself), upon the bones, which must first be put into the centre of a hill of dirt for the acid to have full play, and for the dirt to mixi in with it. Fifty or sixty pounds of acid, to every 100 pounds of bones, mixed with manure, will be sufficient for one acre. Bones can, also, by the addition of strong lye to them, be entirely dissolved. They may not only be applied to the ordinary cultivated crops, but also to meadows and pastures. In some of the older dairy districts, a few bushels of bone dust per acre will at once restore worn out pastures. The reason is that the milk and cheese, which are in one form or another sold and carried away, contain considerable quantities of the phosphates.

These are restored to the land by bones. It is calculated by Prof. Johnston, that a cow giving twenty quarts of milk per day, takes from the soil about two pounds of phosphate of lime or bone earth in each week.

There would thus be required three or four pounds of bones to make good this loss. If it is not made good in some way, the rich grasses, after a time, cease to flourish; being succeeded by those which require less phosphate of lime, and therefore do not furnish, when eaten by the cow, so rich or so abundant milk.

If a farmer wants to utilize the bones on his farm (and

every farmer should), he can do so without much trouble. Bones act very slowly in soil, because they decompose with great difficulty—on account of their compact structure. If they are ground in a plaster mill, they give "bone meal," which is much more active than whole bones. If there is no plaster mill at hand, make a floor of boards under some shed, on which pile all the bones you can get, and mix with them an equal amount of fresh wood ashes; wet the ashes with water, so as to dissolve the potash, that it may act on the animal matter of the bones, but do not use so much water as to make it leach, and the potash thus drip away; stir up the bones and ashes every three days for a month, when you can crush them and break them small with a spade. If you will beat them fine, you will then have a convenient manure, which contains all the valuable elements of both the bone and the ashes. "You will then save yourself from the temptation to sell your ashes to the soap boiler for six to ten cents a bushel, while they are worth twenty-five to thirty cents for your farm. Use this mixture on your corn, wheat, oats and potatoes, and you are paid for all your trouble. Mix it with barnyard manure, or any other fertilizing material you can get to give it bulk, or drop it separately in the hills or drills."

From an address delivered before the Valley Agricultural Society of Virginia, October 21st, 1858:

"During the past summer I heard an opinion expressed by Prof. Henry, the distinguished Secretary of the Smithsonian Institute, which struck me at the time as extravagant, but which a little reflection satisfied me was founded upon the strong probabilities of truth. It was that there was more wealth in our soil in fertilizing matter at the moment this continent was discovered by Columbus, than there is at present, above the surface, in improvements and all other investments. The fertility which ages had accumulated upon its surface, has been the capital upon which the farmer has been drawing with reckless prodigality from the first settlement of the country."

Prevention and Cure of Exhaustion.

"To prevent exhaustion, as well as to remedy it after it has taken place, it is requisite that those elements which have been drawn from the soil should be restored to it. No escape from this necessity is possible, under any circumstances of soil, climate, people or country.

While there is some want of agreement among agricultural chemists, as to what are the precise functions of the various chemical substances which perform a part in the mysterious phenomena of vegetable structure and growth, there is an entire unanimity on the part of all who occupy high position, that this great law or provision for the restitution of the elements must be complied with, or exhaustion is inevitable. Nature will not permit man continuously to draw from the mine of wealth which she has furnished for his use, except under certain restrictions. When the several products which have been given to him have administered to his sustenance, comfort, or convenience, and then performed each its appointed part, the refuse must be given back to the land, becoming again material for aiding in the same process of vegetable nutrition."

"The life of men, of animals, and of plants," says Liebig, "is connected in the closest manner with the return of all the conditions which promote the vital process. The soil, by its constituents, contributes to the life of plants; its continuous fertility is inconceivable and impossible without the return of those conditions which have rendered it productive."

Such being the facts, it must be apparent that the farmer, to manure to the highest advantage and with the utmost economy, must make himself acquainted with the truths of agricultural chemistry. Without a knowledge of this department of science, it is utterly impossible for him to acquire an insight into the properties and comparative value of different manures, the constituents of soil, the elements held in excess, and those which are not present in sufficient quantity, or are entirely wanting.

Liebig has shown that the removal of one bushel of wheat from a given tract of land, and a failure to restore to it any portion of its constituents, decreases the power of that land to produce wheat to an amount equal to one bushel; the farmer who pursues this policy is actually year by year disposing of his capital, and becoming the owner of a farm less and less valuable.

In order to return to the soil its constituents which have been extracted by the crops, and to know how to properly rotate, the reader must intelligently study his Map and Guide.

Accompanying this little book is a Map, which can be hung against the wall, as a ready reference to the farmer in knowing what crops to put in any particular soil, how to rotate the crops, and what to add to the soil.

The grower of tobacco will find the fertilizer he wishes to use will be composed of the Phosphates, Potash, Ammonia and Lime. Taking from his compost heap the quantity of manure he desires for his crop of tobacco, he will add in small quantities the Phosphoric Acid (bones), Potash (ashes), and Lime or Plaster.

Lime,	"	25 "	alysis, it is found com-	75 "
Magn	"	3 "	posed chiefly	10 "
Potash	"	20 "	of Phosphates	7 "
Soda,	"	2 "	Potash and	4 "
Silicat	"	40 "	Lime, the two	Fr. prt.
Iron,	ac'n	Frac'n	latter largely in excess.	" "
Loss,				

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MAP OF

THE ENGLISH LANDMARKS

OF THE SOIL AND CROPS,

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Table of Composition of the Soil.

Composition of 100 Pounds of Earth.	Rich Land.	Fair Land.	Poor Land.
Oil of Vitriol found in Plaster, ...	Fractional part.	Fractional part.	None.
Phosphates gotten from Bones, ...	" "	" "	"
Limestone, called Lime, Plaster, Magnesia, .	5 per cent.	2 per cent.	Fractional part.
Potash, in Wood Ashes, ...	Fractional part.	None.	None.
Silica, in Sand, Gravel, &c., ...	65 per cent.	80 per cent.	80 per cent.
Iron, ...	5 " "	6 " "	9 " "
Vegetable and Animal Matter, ...	13 " "	6 " "	1 " "
Alumina, in Clay, ...	8 " "	5 " "	9 " "
Loss, ...			

Table of Composition of the Crops.

In 100 Pounds Ashes.	Corn.	Wheat	Wheat Straw.	Rye.	Oats.	Peas.	Beans	Potatoes.	Turnips.	Hay.	Tobacco.	Fruit Trees.
Oil of Vitriol in Plaster,	Frac'n	Frac'n	Frac'n	Frac'n	8pr.c.	3pr.c.	3pr.c.	8pr.c.	12pr.c.	3pr.c.	Without an	. . . . . .
Phosphates in Bones,	50pr.c.	45pr.c.	3 pr. c.	46pr.c.	46 "	35 "	35 "	8 "	8 "	6 "	accurate analysis it is	3pr.c.
Lime, ...	Frac'n	3 "	9 "	3 "	5 "	3 "	5 "	2 "	5 "	25 "	found com-	75 "
Magnesian Limestones	16pr.c.	16 "	6 "	10 "	10 "	9 "	9 "	10 "	9 "	3 "	posed chiefly	10 "
Potash, in Ashes,	25pr.c.	30 "	8 "	34 "	15 "	29 "	24 "	55 "	50 "	20 "	of Phosphates	7 "
Soda, in Common Salt,	4 pr. c.	1 "	Frac'n	3 "	15 "	15 "	18 "	. . . . . .	5 "	2 "	Potash and	4 "
Silicates, in Sand,	Frac'n	2 "	70pr.c.	Frac'n	1 "	Frac'n	1 "	9 pr. c.	8 "	40 "	Lime, the two	Fr.prt.
Iron, ...	"	Frac'n	Frac'n	"	Frac'n	"	Frac'n	Frac'n	Frac'n	Frac'n	latter largely in excess.	" "
Loss, ...												

Hang this up or Frame it, for Convenient Reference.

"Economy in the Government of the Soil, is more important than the Economy of State."

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